

BOX PCT

"Express Mail" mailing label number EL 919773942 US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE  
(DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER		
ARNO118771		
U.S. APPLICATION NO (if known see 37 C F R 1.5)		
10/069866		
INTERNATIONAL APPLICATION NO	INTERNATIONAL FILING DATE	EARLIEST PRIORITY DATE CLAIMED
PCT/EP00/08552	30 August 2000	30 August 1999
TITLE OF INVENTION		
STRENGTHENING LAYER FOR USE IN COMPOSITES TO BE FORMED BY MEANS OF VACUUM TECHNIQUE		
APPLICANT(S) FOR DO/EO/US		
CLAEYS, Etienne		

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information by **Express Mail**:

- ☒ 1. This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
- ☐ 2. This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 37 U.S.C. 371.
- ☒ 3. This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
- ☒ 4. A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
- ☒ 5. A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - ☒ a. is attached hereto (required only if not communicated by the International Bureau).
  - ☒ b. has been communicated by the International Bureau.
  - ☐ c. is not required, as the application was filed in the United States Receiving Office (RO/US).

LAW OFFICES OF  
CHRISTENSEN O'CONNOR JOHNSON KINDNESS<sup>PLLC</sup>  
1420 Fifth Avenue  
Suite 2800  
Seattle, Washington 98101  
206.682.8100

- \_\_\_\_\_ 6. An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
- X 7. Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
- \_\_\_\_\_ a. are attached hereto (required only if not communicated by the International Bureau).
- \_\_\_\_\_ b. have been communicated by the International Bureau.
- \_\_\_\_\_ c. have not been made; however, the time limit for making such amendments has NOT expired.
- X d. have not been made and will not be made.
- \_\_\_\_\_ 8. An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
- \_\_\_\_\_ 9. An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
- \_\_\_\_\_ 10. An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11. to 20. below concern document(s) or information included:**

- X 11. An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98.
- \_\_\_\_\_ 12. An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included.
- \_\_\_\_\_ 13. A FIRST preliminary amendment.
- \_\_\_\_\_ 14. A SECOND or SUBSEQUENT preliminary amendment.
- \_\_\_\_\_ 15. A substitute specification.
- \_\_\_\_\_ 16. A change of power of attorney and/or address letter.
- \_\_\_\_\_ 17. A computer-readable form of the sequence listing in accordance with 35 U.S.C. 1.821 – 1.825.
- \_\_\_\_\_ 18. A second copy of the published international application under 35 U.S.C. 154(d)(4).
- \_\_\_\_\_ 19. A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
- X 20. Other items or information:
- X International Preliminary Examination Report.

<input checked="" type="checkbox"/> 21. The following fees are submitted:				<b>CALCULATIONS</b> <small>PTO USE ONLY</small>	
<b>BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5):</b> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO .....\$1,040.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$890.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....\$740.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4).....\$710.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) .....\$100.00 <div style="text-align: right; margin-top: 10px;"> <b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b> </div>					
Surcharge of \$130.00 for furnishing the oath or declaration later than ____ 20 30 months from the earliest claimed priority date (37 CFR 1.492(e))				\$	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	21 - 20 =	1	X \$18.00	\$18.00	
Independent claims	3 - 3 =	0	X \$84.00	\$	
MULTIPLE DEPENDENT CLAIMS(S) (if applicable)			+ \$280.00	\$280.00	
<b>TOTAL OF ABOVE CALCULATIONS =</b>				\$1,188.00	
____ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				\$	
<b>SUBTOTAL =</b>				\$1,188.00	
Processing fee of \$130.00 for furnishing the English translation later than ____ 20 ____ 30 months from the earliest claimed priority date (37 CFR 1.492(f))				\$	
<b>TOTAL NATIONAL FEE =</b>				\$1,188.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)) The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) \$40.00 per property				\$	
<b>TOTAL FEES ENCLOSED =</b>				\$1,188.00	
				Amount to be:	\$
				refunded	
				charged	\$

LAW OFFICES OF  
 CHRISTENSEN O'CONNOR JOHNSON KINDNESS<sup>PLLC</sup>  
 1420 Fifth Avenue  
 Suite 2800  
 Seattle, Washington 98101  
 206.682.8100

- X   a. Check No. 136423 in the amount of \$1,188.00 to cover the above fees is enclosed.
- b. Please charge my Deposit Account No.        in the amount of \$        to cover the above fees. A duplicate copy of this sheet is enclosed.
- X   c. The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 03-1740. A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

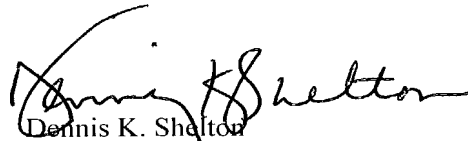
SEND ALL CORRESPONDENCE TO:

**Customer No. 26389**

Dennis K. Shelton  
CHRISTENSEN O'CONNOR JOHNSON KINDNESS<sup>PLLC</sup>  
1420 Fifth Avenue  
Suite 2800  
Seattle, WA 98101

Respectfully submitted,

CHRISTENSEN O'CONNOR  
JOHNSON KINDNESS<sup>PLLC</sup>

  
Dennis K. Shelton  
Direct Dial No. 206.695.1718  
E-Mail Address: dennis@cojk.com

**EXPRESS MAIL CERTIFICATE**

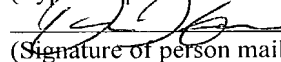
"Express Mail" mailing label number EL 919773942 US

Date of Deposit February 26, 2002

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10 on the date indicated above and is addressed to Box PCT, Commissioner for Patents, U.S. Patent and Trademark Office, P.O. Box 2327, Arlington, VA 22202.

Dennis Hanson

(Typed or printed name of person mailing paper or fee)

  
(Signature of person mailing paper or fee)

DKS:cj

LAW OFFICES OF  
CHRISTENSEN O'CONNOR JOHNSON KINDNESS<sup>PLLC</sup>  
1420 Fifth Avenue  
Suite 2800  
Seattle, Washington 98101  
206.682.8100

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: E. Claeys

Attorney Docket No.: ARNO118771

Application No.: 10/069,866

Filed: February 26, 2002

Title: STRENGTHENING LAYER FOR USE IN COMPOSITES TO BE FORMED  
BY MEANS OF VACUUM TECHNIQUE

PRELIMINARY AMENDMENT

Seattle, Washington 98101

July 1, 2002

TO THE COMMISSIONER FOR PATENTS:

Please amend the above-identified application as indicated below.

In the Claims:

Please amend Claims 1-20 as follows, and add Claims 21-32 as shown below.

1. (Amended) A strengthening layer for composites comprising a resin to be formed by means of a vacuum technique, comprising:

a strengthening material; and

a plurality of transport threads of substantially round and substantially form-retaining cross-section for guiding the resin therealong wherein said threads lie substantially in the direction of the resin transport.

2. (Amended) The strengthening layer as claimed in claim 1 wherein the transport threads lie in the same plane as the rest of the strengthening material.

3. (Amended) The strengthening layer as claimed in claim 1 wherein the transport threads lie against one or both sides of the strengthening layer.

4. (Amended) The strengthening layer as claimed in claim 1 wherein the strengthening material takes at least partly the form of endless threads lying substantially parallel adjacently of each other.

LAW OFFICES OF  
CHRISTENSEN O'CONNOR JOHNSON KINDNESS<sup>SM</sup>  
1420 Fifth Avenue  
Suite 2800  
Seattle, Washington 98101  
206.682.8100

5. (Amended) The strengthening layer as claimed in claim 1 wherein the form-retention of the transport threads is achieved in that said threads comprise at least two twined single threads.

6. (Amended) The strengthening layer as claimed in claim 1 wherein the form-retention of the transport threads is achieved in that said threads comprise torsional single threads.

7. (Amended) The strengthening layer as claimed in claim 1 wherein the form-retention of the transport threads is achieved in that said threads further comprise a coating applied to at least a partial surface of the thread.

8. (Amended) The strengthening layer as claimed in claim 7 wherein the coating is a glue.

9. (Amended) The strengthening layer as claimed in claim 1 wherein the form-retention of the transport threads is achieved in that said threads are monofilament threads.

10. (Amended) The strengthening layer as claimed in claim 1 wherein the form-retention of the transport threads is achieved in that said threads are provided with a sheath.

11. (Amended) The strengthening layer as claimed in claim 10 wherein the sheath comprises a knit.

12. (Amended) The strengthening layer as claimed in claim 10 wherein the sheath comprises a braiding.

13. (Amended) The strengthening layer as claimed in claim 1 wherein the form-retention of the transport threads is achieved in that said threads form part of a structure of threads which are mutually connected by a binding such that the round form of the transport threads is substantially form-retaining during the vacuum technique.

14. (Amended) The strengthening layer as claimed in claim 13 wherein the form-retention of the transport threads is achieved in that said threads form part of a gauze.

LAW OFFICES OF  
CHRISTENSEN O'CONNOR JOHNSON KINDNESS<sup>PLLC</sup>  
1420 Fifth Avenue  
Suite 2800  
Seattle, Washington 98101  
206.682.8100

15. (Amended) The strengthening layer as claimed in claim 13 wherein the form-retention of the transport threads is achieved in that said threads form part of a web manufactured according to the Rachel technique.

16. (Amended) The strengthening layer as claimed in claim 1 wherein the transport threads are formed from at least one of glass, carbon, kevlar, flax, other vegetable, synthetic fibres and combinations thereof.

17. (Amended) The strengthening layer as claimed in claim 1 wherein the strengthening material is formed from at least one of glass, kevlar, flax, other vegetable, synthetic fibres and combinations thereof.

18. (Amended) The strengthening layer as claimed in claim 1 wherein the transport threads are manufactured from at least one of the same materials as the strengthening material.

19. (Amended) A method of forming a resin composite by means of a vacuum technique, comprising providing at least one strengthening layer comprising a plurality of transport threads of substantially round and substantially form-retaining cross-section for guiding the resin therealong, orienting the strengthening layer so that said threads lie substantially in the direction of the resin transport, and applying the resin to the strengthening layer under vacuum to form the composite.

20. (Amended) A composite formed by means of a vacuum technique, comprising at least one strengthening layer embedded in resin wherein said strengthening layer comprises a plurality of transport threads of substantially round and substantially form-retaining cross-section for guiding the resin therealong, and wherein said threads lie substantially in the direction of the resin transport.

21. (New) The strengthening layer as claimed in claim 1 wherein said layer is embedded in resin.

LAW OFFICES OF  
CHRISTENSEN O'CONNOR JOHNSON KINDNESS<sup>PLLC</sup>  
1420 Fifth Avenue  
Suite 2800  
Seattle, Washington 98101  
206.682.8100

22. (New) The strengthening layer as claimed in claim 4 wherein the strengthening material at least partly takes the form of multifilaments.

23. (New) The strengthening layer as claimed in claim 4 wherein the transport threads lie in the same plane as the rest of the strengthening material.

24. (New) The strengthening layer as claimed in claim 4 wherein the transport threads lie against one or both sides of the strengthening layer.

25. (New) The method of claim 19 wherein the transport threads lie in the same plane as the rest of the strengthening material.

26. (New) The method of claim 19 wherein the transport threads lie against one or both sides of the strengthening layer.

27. (New) The method of claim 19 wherein the strengthening material takes at least partly the form of multifilaments.

28. (New) The method of claim 19 wherein the form-retention of the transport threads is achieved by comprising at least one of a plurality of twined single threads, torsional single threads, and monofilament threads.

29. (New) The method of claim 19 wherein the transport threads are formed from at least one of glass, carbon, kevlar, flax, other vegetable and synthetic fibres and combinations thereof.

30. (New) The method of claim 19 wherein the strengthening material is formed from at least one of glass, kevlar, flax, other vegetable and synthetic fibres and combinations thereof.

31. (New) The method of claim 19 wherein at least one strengthening layer is embedded in resin.

32. (New) A system for forming a composite by means of vacuum through a closed mould comprising:

a strengthening layer; and

means for guiding a resin along the strengthening layer, said strengthening layer comprising substantially round transport threads which lie substantially in the direction of the resin transport, wherein the mould retains its cross-sectional shape.

REMARKS

Claims 1-20 are pending in the application and have not yet been examined. Claims 1-20 have been amended to correct certain formalities. Claims 21-32 have been added. These claims are supported by the application as originally filed. Consideration and allowance of Claims 1-32 is respectfully requested.

Respectfully submitted,

CHRISTENSEN O'CONNOR  
JOHNSON KINDNESS<sup>PLLC</sup>

*Dennis Shelton by*  
*Robert J. Fullin 34,034*  
Dennis K. Shelton  
Registration No. 26,997  
Direct Dial No. 206.695.1718

I hereby certify that this correspondence is being deposited with the U.S. Postal Service in a sealed envelope as first class mail with postage thereon fully prepaid and addressed to the Box PCT, Commissioner for Patents, U.S. Patent and Trademark Office, P.O. Box 2327, Arlington, VA 22202, on the below date.

Date: 7/1/02

*Carole Julep*

DKS:TJQ

LAW OFFICES OF  
CHRISTENSEN O'CONNOR JOHNSON KINDNESS<sup>PLLC</sup>  
1420 Fifth Avenue  
Suite 2800  
Seattle, Washington 98101  
206.682.8100

VERSION WITH MARKINGS TO SHOW CHANGES MADE JULY 1, 2002

In the Claims:

1. (Amended) A [Strengthening] strengthening layer for composites comprising a resin to be formed by means of a vacuum technique, [which layer substantially consists of] comprising:

a strengthening material; and

[for a smaller part] a plurality of transport threads of substantially round and substantially form-retaining cross-section for guiding the resin therealong[, which] wherein said threads lie substantially in the direction of the resin transport.

2. (Amended) The [Strengthening] strengthening layer as claimed in claim 1[, characterized in that] wherein the transport threads lie in the same plane as the rest of the strengthening material.

3. (Amended) The [Strengthening] strengthening layer as claimed in claim 1 [or 2, characterized in that] wherein the transport threads lie against one or both sides of the strengthening layer.

4. (Amended) The [Strengthening] strengthening layer as claimed in [claims 1-3, characterized in that] claim 1 wherein the strengthening material takes at least partly the form of endless threads lying substantially parallel adjacently of each other [, or multifilaments].

5. (Amended) The [Strengthening] strengthening layer as claimed in [claims 1-4, characterized in that] claim 1 wherein the form-retention of the transport threads is achieved in that [they consist of] said threads comprise at least two [or more] twined single threads.

6. (Amended) The [Strengthening] strengthening layer as claimed in [claims 1-4, characterized in that] claim 1 wherein the form-retention of the transport threads is achieved in that [they consist of] said threads comprise torsional single threads.

LAW OFFICES OF  
CHRISTENSEN O'CONNOR JOHNSON KINDNESS<sup>TM</sup>  
1420 Fifth Avenue  
Suite 2800  
Seattle, Washington 98101  
206.682.8100

7. (Amended) The [Strengthening] strengthening layer as claimed in [claims 1-4, characterized in that] claim 1 wherein the form-retention of the transport threads is achieved in that [they consist of] said threads further comprise a coating applied to [the whole or partial surface of the thread] at least a partial surface of the thread.

8. (Amended) The [Strengthening] strengthening layer as claimed in claim 7 [, characterized in that] wherein the coating is a glue.

9. (Amended) The [Strengthening] strengthening layer as claimed in [claims 1-4, characterized in that] claim 1 wherein the form-retention of the transport threads is achieved in that [they] said threads are monofilament threads.

10. (Amended) The [Strengthening] strengthening layer as claimed in [claims 1-4, characterized in that] claim 1 wherein the form-retention of the transport threads is achieved in that [they] said threads are provided with a sheath.

11. (Amended) The [Strengthening] strengthening layer as claimed in claim 10 [, characterized in that] wherein the sheath [consists of] comprises a knit.

12. (Amended) The [Strengthening] strengthening layer as claimed in claim 10 [, characterized in that] wherein the sheath [consists of] comprises a braiding.

13. (Amended) The [Strengthening] strengthening layer as claimed in [claims 1-4, characterized in that] claim 1 wherein the form-retention of the transport threads is achieved in that [they] said threads form part of a structure of threads which are mutually connected by a binding such that the round form of the transport threads [cannot be distorted, or hardly so] is substantially form-retaining during the vacuum technique.

14. (Amended) The [Strengthening] strengthening layer as claimed in claim 13 [, characterized in that] wherein the form-retention of the transport threads is achieved in that [they] said threads form part of a gauze.

15. (Amended) The [Strengthening] strengthening layer as claimed in claim 13 [, characterized in that] wherein the form-retention of the transport threads is achieved in that [they] said threads form part of a web manufactured according to the Rachel technique.

16. (Amended) The [Strengthening] strengthening layer as claimed in [any of the foregoing claims, characterized in that] claim 1 wherein the transport threads are formed from at least one of glass, carbon, kevlar, flax, other vegetable [or], synthetic fibres [or] and combinations thereof.

17. (Amended) The [Strengthening] strengthening layer as claimed in [any of the foregoing claims, characterized in that] claim 1 wherein the strengthening material is formed from at least one of glass, kevlar, flax, other vegetable [or], synthetic fibres [or] and combinations thereof.

18. (Amended) The [Strengthening] strengthening layer as claimed in [any of the foregoing claims, characterized in that] claim 1 wherein the transport threads are manufactured from at least one of the same [material] materials as the strengthening material [of which the rest of the layer consists].

19. (Amended) [Assembly of strengthening layers,] A method of forming a resin composite by means of a vacuum technique, comprising [at least one strengthening layer as claimed in any of the foregoing claims] providing at least one strengthening layer comprising a plurality of transport threads of substantially round and substantially form-retaining cross-section for guiding the resin therealong, orienting the strengthening layer so that said threads lie substantially in the direction of the resin transport, and applying the resin to the strengthening layer under vacuum to form the composite.

20. (Amended) A [Composite] composite [consisting of at least one layer] formed by means of a vacuum technique, comprising at least one strengthening layer embedded in resin, [as

claimed in claims 1-18 or an assembly as claimed in claim 19] wherein said strengthening layer comprises a plurality of transport threads of substantially round and substantially form-retaining cross-section for guiding the resin therealong, and wherein said threads lie substantially in the direction of the resin transport.

New Claims 21-32 have been added.

LAW OFFICES OF  
CHRISTENSEN O'CONNOR JOHNSON KINDNESS<sup>SM</sup>  
1420 Fifth Avenue  
Suite 2800  
Seattle, Washington 98101  
206.682.8100

STRENGTHENING LAYER FOR USE IN COMPOSITES  
TO BE FORMED BY MEANS OF VACUUM TECHNIQUE

The present invention relates to a strengthening layer for composites to be formed by means of vacuum technique, as well as to an assembly of strengthening layers and composites containing the strengthening  
5 layer.

Vacuum techniques are used to make composites in a closed mould system. A vacuum is produced in the mould by means of a small opening on an outer end of the mould, while the resin is supplied at the other end via a small  
10 opening. The resin will fill the mould due to the underpressure in the mould.

Quite simple moulds are usually applied in such techniques. In some cases such moulds consist only of a lower mould with a cover foil. When a vacuum is produced  
15 in the mould there results an external pressure on the mould of about 1 bar. When the mould is partially flexible, such as when a cover foil is applied as upper mould, this pressure is also exerted on the strengthening layer present in mould. Since the mould as it were  
20 collapses and the strengthening layer is herein also compressed, the resin transport is in many cases made more difficult or even prevented.

Because the vacuum technique can be used with relatively low mould costs, it is an advantageous method.  
25 To nevertheless enable the use of this vacuum technique with these simple moulds use is currently made of so-called "bleeders". These are intermediate layers inserted between the strengthening layers so as to still allow resin transport. Such "bleeders" are for instance  
30 continuous glass mats, which cannot be compressed by the external pressure on the mould and its content. Such "bleeders" are however generally a disruptive element in the end product since they cause unnecessary thickness, weight, resin and material consumption. Furthermore, they

leave behind a resin-rich location in the end product, thereby creating the danger of air inclusion.

The present invention therefore has for its object to provide a strengthening layer which is particularly  
5 suitable for forming composites by means of vacuum technique.

This is achieved with the invention by a strengthening layer which substantially consists of a strengthening material and for a smaller part of  
10 transport threads of substantially round and substantially form-retaining cross-section for guiding the resin therealong, which threads lie substantially in the direction of the resin transport. Because of the form-retaining nature of the transport threads they are  
15 not flattened by the external pressure but retain their form. It has been found that sufficient openings thereby remain along the threads to enable resin transport. The transporting speed of the resin can be influenced by the choice of the thread thickness and by the number of  
20 threads.

The transport threads can lie in the same plane as the rest of the strengthening material. In that case they preferably replace a part of this material, whereby no extra weight is added. The invention is however also  
25 effective when the transport threads are situated between the different layers of strengthening material.

Although the problem of the strengthening material being compressed can occur with different types of strengthening material, it is a particular problem in the  
30 case of strengthening material which takes at least partly the form of endless threads lying substantially parallel adjacently of each other, or multifilaments. Multifilaments are bundles of separate threads which are not mutually attached to each other within a bundle and  
35 are also not intertwined. They therefore spread into a flat surface in the case of external pressure.

The form-retention of the transport threads according to the invention can be achieved in different

ways. It is thus possible to apply two or more twined single threads or a torsional single thread. In addition, form-retention can also be achieved by means of a substantially rigid coating applied to the whole or  
5 partial surface of the thread. Such a coating again ensures that the threads cannot be compressed. Although it is evident that a coating over the whole surface gives the best result, it is however also possible, in order to save material, to suffice with a coating in parts at  
10 intermediate distances such that sufficient rigidity is provided for the threads to prevent compression thereof under a pressure of about 1 bar. As coating can for instance be used a glue or other finishes known in the art of textile processing.

15 When the transport threads are monofilament threads, they already form one whole and for this reason cannot be flattened. A similar result can be achieved when the transport threads are provided with a sheath. Such a sheath can for instance be a knit or a braiding. The  
20 form-retention of the transport threads can likewise further be ensured in that they form part of a structure of threads which are mutually connected by a binding such that the round form of the transport threads cannot be distorted, or hardly so. Examples of such structures are  
25 for instance gauzes or webs manufactured according to Rachel technique.

Both the strengthening materials and the transport threads according to the invention can be formed from the usual strengthening materials applied for the  
30 reinforcement of plastics, such as glass, carbon, kevlar, flax, other vegetable or synthetic fibres or combinations thereof. The material applied for the transport threads can be the same as the rest of the strengthening material or different. Glass is mostly used as strengthening  
35 material and as material for the transport threads.

A strengthening layer according to the invention will in practice generally be applied in an assembly of a plurality of layers. Such an assembly comprises at least

In this application "composite" is understood to mean a material in which the supporting function is taken

over almost entirely by the reinforcement material (strengthening material). The resin herein has a sealing character and functions for the purpose of cohesion and stress transfer.

5 "Vacuum technique" is understood to mean the suction of resin by means of vacuum through a closed mould having therein one or more strengthening layers for the purpose of forming a composite.

A "strengthening layer" is a quantity of  
10 strengthening material displaying cohesion. The term "strengthening material" is used for the components of which a strengthening layer consists, such as multifilaments, glass rovings and so on.

The invention will be further elucidated with  
15 reference to the example following hereinbelow.

#### EXAMPLE

##### Comparison of resin transport in different types of strengthening material

###### 20 1. Test arrangement

The elongate strengthening layer for testing was placed between two sheets of foil functioning as mould. The foil sheets were sealed all round in order to enable creation of a vacuum in the mould. A vacuum was applied  
25 at the one end of the mould, while resin was fed into the mould at the other end. A measuring rule was positioned in longitudinal direction of the mould to enable determining of the distance covered by the resin per unit of time.

30

###### 2. Strengthening materials

As first comparison material an assembly of strengthening layers was manufactured from six layers of unidirectional webs, wherein in longitudinal direction  
35 each layer had a weight of 1125 g/m<sup>2</sup> glass rovings and in transverse direction a weight of 75 g/m<sup>2</sup> glass rovings. A glass mat of 50 g/m<sup>2</sup> was attached hereto. Such an assembly cannot be formed without any problem into a composite by

means of vacuum techniques. A continuous glass mat of 450 g was therefore placed as "bleeder" between the third and fourth layer of unidirectional webs. The thickness of this continuous mat was roughly 0.8 mm. The thickness of each layer of unidirectional web was 0.9 mm.

As second comparison material the above described assembly of strengthening layers was used without the bleeder.

In the material according to the invention 20 g/m<sup>2</sup> glass roving in the above mentioned web of 1250 g/m<sup>2</sup> was replaced by twined glass yarn in the direction in which the resin transport has to be directed. The web is not changed appreciably by this replacement.

### 3. Result

By means of the comparison material with the stated (continuous mat) bleeder the resin can be transported over about 35 cm in 15 minutes with the vacuum technique. Without the continuous glass mat as bleeder the transport is found to amount to only 10 cm in 15 minutes. The resin transport in the material according to the invention amounts to 35 cm in 15 minutes.

It can be seen from the foregoing that with much less material and in simple manner an at least equally good result can be obtained according to the invention as when a bleeder is applied.

\*\*\*\*\*

## CLAIMS

1. Strengthening layer for composites to be formed by means of vacuum technique, which layer substantially consists of a strengthening material and for a smaller part of transport threads of substantially round and substantially form-retaining cross-section for guiding the resin therealong, which threads lie substantially in the direction of the resin transport.

2. Strengthening layer as claimed in claim 1, characterized in that the transport threads lie in the same plane as the rest of the strengthening material.

3. Strengthening layer as claimed in claim 1 or 2, characterized in that the transport threads lie against one or both sides of the strengthening layer.

4. Strengthening layer as claimed in claims 1-3, characterized in that the strengthening material takes at least partly the form of endless threads lying substantially parallel adjacently of each other, or multifilaments.

5. Strengthening layer as claimed in claims 1-4, characterized in that the form-retention of the transport threads is achieved in that they consist of two or more twined single threads.

6. Strengthening layer as claimed in claims 1-4, characterized in that the form-retention of the transport threads is achieved in that they consist of torsional single threads.

7. Strengthening layer as claimed in claims 1-4, characterized in that the form-retention of the transport threads is achieved in that they consist of a coating applied to the whole or partial surface of the thread.

8. Strengthening layer as claimed in claim 7, characterized in that the coating is a glue.

9. Strengthening layer as claimed in claims 1-4, characterized in that the form-retention of the transport

threads is achieved in that they are monofilament threads.

10. Strengthening layer as claimed in claims 1-4, **characterized in that** the form-retention of the transport  
5 threads is achieved in that they are provided with a sheath.

11. Strengthening layer as claimed in claim 10, **characterized in that** the sheath consists of a knit.

12. Strengthening layer as claimed in claim 10,  
10 **characterized in that** the sheath consists of a braiding.

13. Strengthening layer as claimed in claims 1-4, **characterized in that** the form-retention of the transport threads is achieved in that they form part of a structure of threads which are mutually connected by a binding such  
15 that the round form of the transport threads cannot be distorted, or hardly so.

14. Strengthening layer as claimed in claim 13, **characterized in that** the form-retention of the transport threads is achieved in that they form part of a gauze.

20 15. Strengthening layer as claimed in claim 13, **characterized in that** the form-retention of the transport threads is achieved in that they form part of a web manufactured according to the Rachel technique.

16. Strengthening layer as claimed in any of the  
25 foregoing claims, **characterized in that** the transport threads are formed from glass, carbon, kevlar, flax, other vegetable or synthetic fibres or combinations thereof.

17. Strengthening layer as claimed in any of the  
30 foregoing claims, **characterized in that** the strengthening material is formed from glass, carbon, kevlar, flax, other vegetable or synthetic fibres or combinations thereof.

18. Strengthening layer as claimed in any of the  
35 foregoing claims, **characterized in that** the transport threads are manufactured from the same material as the strengthening material of which the rest of the layer consists.

WO 01/15887

PCT/EP00/08552

9

19. Assembly of strengthening layers, comprising at least one strengthening layer as claimed in any of the foregoing claims.

20. Composite consisting of at least one layer  
 5 embedded in resin as claimed in claims 1-18 or an assembly as claimed in claim 19.

\*\*\*\*\*

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
8 March 2001 (08.03.2001)

PCT

(10) International Publication Number  
**WO 01/15887 A1**

(51) International Patent Classification<sup>7</sup>: **B29C 70/54,**  
70/20

(21) International Application Number: **PCT/EP00/08552**

(22) International Filing Date: 30 August 2000 (30.08.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
1012935 30 August 1999 (30.08.1999) NL

(71) Applicant (for all designated States except US): **SYNCO-GLAS S.A.** [BE/BE]; Drukkerijstraat 9, B-9240 Zele (BE).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **CLAEYS, Etienne**  
[BE/BE]; Oude Heerwegheide 63A, B-9250 Waasmunster (BE).

(74) Agent: **VAN SOMEREN, Petronella, Francisca, Hendrika, Maria;** Arnold & Siedsma, Sweelinckplein 1, NL-2517 GK The Hague (NL).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

**Published:**

- With international search report.
- Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **STRENGTHENING LAYER FOR USE IN COMPOSITES TO BE FORMED BY MEANS OF VACUUM TECHNIQUE**

(57) Abstract: The invention relates to a strengthening layer for composites to be formed by means of vacuum technique, which layer substantially consists of a strengthening material and for a smaller part of substantially round transport threads for guiding the resin therealong, which threads are substantially form-retaining in cross-section and lie substantially in the direction of the resin transport.

**WO 01/15887 A1**

Attorney Docket No. ARNO118771

COMBINED DECLARATION AND POWER OF ATTORNEY  
IN PATENT APPLICATION

As the below-named inventor, I hereby declare that:

my residence, mailing address, and citizenship are as stated below next to my name.

I believe that I am the original, first, and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled STRENGTHENING LAYER FOR USE IN COMPOSITES TO BE FORMED BY MEANS OF VACUUM TECHNIQUE, the specification of which was filed on August 30, 2000, as PCT International Application No. PCT/EP00/08552 (now U.S. Application No. 10/069,866).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with 37 C.F.R. 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below, and I have also identified below any foreign application for patent or inventor's certificate, or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application No(s).	Country	Foreign Filing Date Month/Day/Year	Priority Claimed Yes/No
1012935	Netherlands	August 30, 1999	Yes

I hereby appoint the following attorneys and/or agents to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith: Bruce E. O'Connor, Reg. No. 24,849; Lee E. Johnson, Reg. No. 22,946; Gary S. Kindness, Reg. No. 22,178; James W. Anable, Reg. No. 26,827; James R. Uhlir, Reg. No. 25,096; Jerald E. Nagae, Reg. No. 29,418; Dennis K. Shelton, Reg. No. 26,997; Jeffrey M. Sakoi, Reg. No. 32,059; Ward Brown, Reg. No. 28,400; Robert J. Carlson, Reg. No. 35,472; Rodney C. Tullett, Reg. No. 34,034; Daiva K. Tautvydas, Reg. No. 36,077; Mary L. Culic, Reg. No. 40,574; Julie C. VanDerZanden, Reg. No. 38,105; George E. Renzoni, Ph.D., Reg. No. 37,919; Philip P. Mann, Reg. No. 30,960; George S. Farber, Reg. No. 41,497; Kevan L. Morgan, Reg. No. 42,015; and John D. Denkenberger, Reg. No. 44,060; and the firm of Christensen O'Connor Johnson Kindness<sup>PLLC</sup>. Address all telephone calls to Dennis K. Shelton at telephone No. 206.695.1718.


Address all correspondence to:

**Customer No. 26389**

CHRISTENSEN O'CONNOR JOHNSON KINDNESS<sup>PLLC</sup>  
1420 Fifth Avenue, Suite 2800  
Seattle, WA 98101

I hereby further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

1-00

Full Name of Inventor	Citizenship
<u>Etienne Claeys</u>	<u>Belgium</u>
Residence	
<u>Waasmunster, Belgium</u>	<u>BEX</u>
Mailing Address	
<u>Oude Heerwegheide 63A, B-9250 Waasmunster, Belgium</u>	
Inventor's Signature	Date
<u></u>	<u>09.06.02</u>

DKS:cj